Spot the Pattern

Sort functions by how their outputs change.

8A.AF.H.23 "Compare properties of two functions, each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). Include linear, quadratic, exponential, absolute value, and linear piecewise. a..."

NAME _____ DATE _____

LINEAR	NONLINEAR
When the input increases by equal amounts, the output changes by the same amount each time. Its graph is one straight line. A candle loses 1 centimeter of height each hour while it burns.	When the input increases by equal amounts, the output does not always change by the same amount. Its graph is not one straight line. $y = x^3$

1 SORT

8 items

For each numbered item, circle LINEAR or NONLINEAR, then choose one item from each category and explain how you knew.

1. $y = 3x - 2$ — LINEAR / NONLINEAR

2. $y = x^2 + 1$ — LINEAR / NONLINEAR

3. $y = 2^x + 5$ — LINEAR / NONLINEAR

4. Inputs 0, 1, 2, 3 give outputs 6, 10, 14, 18. — LINEAR / NONLINEAR

5. A bike rental costs $8 plus $3 for each hour. — LINEAR / NONLINEAR

6. $y = -2x + 9$ — LINEAR / NONLINEAR

7. $y = |x - 4|$ — LINEAR / NONLINEAR

8. $y = x + 2$ when $x < 0$; $y = 3x + 2$ when $x \geq 0$. — LINEAR / NONLINEAR

2 PROVE IT

Explain your thinking

Choose one item from each category and explain how you knew.

ITEM # _____ **HOW I KNEW** _____

ITEM # _____ **HOW I KNEW** _____

3 MAKE YOUR OWN

One of each

Write one new linear function and one new nonlinear function.

LINEAR

NONLINEAR

CHALLENGE

Describe a linear function in words and write a nonlinear function as an equation so both output 2 when x = 0 and 3 when x = 1; compare their outputs when x = 2.

ANSWER KEY # Spot the Pattern

GRADE 8 · 8A.AF.H.23

PART 1 · SORT

#	ITEM	CATEGORY	WHY
1	$y = 3x - 2$	**LINEAR**	The output increases by 3 for each increase of 1 in x.
2	$y = x^2 + 1$	**NONLINEAR**	The output changes are not constant for equal increases in x.
3	$y = 2^x + 5$	**NONLINEAR**	The exponential term makes the output changes nonconstant.
4	Inputs 0, 1, 2, 3 give outputs 6, 10, 14, 18.	**LINEAR**	The output increases by 4 each time the input increases by 1.
5	A bike rental costs $8 plus $3 for each hour.	**LINEAR**	The cost increases by $3 for each additional hour.
6	$y = -2x + 9$	**LINEAR**	The output decreases by 2 for each increase of 1 in x.
7	$y = \|x - 4\|$	**NONLINEAR**	The graph changes direction at $x = 4$, so it is not one straight line.
8	$y = x + 2$ when $x < 0$; $y = 3x + 2$ when $x \geq 0$.	**NONLINEAR**	The rate of change switches from 1 to 3, so the graph is not one straight line.

PART 2 · PROVE IT

Task: Choose one item from each category and explain how you knew.
Accept any explanation that names the deciding feature from the rule box for the chosen item.

PART 3 · MAKE YOUR OWN (SAMPLE ANSWERS)

- **LINEAR**: $y = 5x - 6$
- **NONLINEAR**: $y = x^2 - 3$

Challenge: The output starts at 2 and rises by 1 whenever x rises by 1. The nonlinear rule is $y = x^2 + 2$. When $x = 2$, the linear output is 4 and the nonlinear output is 6.

For Part 2, accept explanations that identify a constant rate for the linear item and a changing rate or direction for the nonlinear item. In Part 3, accept any unambiguous examples that fit the two categories.